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Review of 2008 growing season from a pathologist's perspective

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Environment plays an important role in disease development, not only in the infection by and growth of the pathogen, but also for the growth and development of the host plant (i.e., corn and soybean crop). As we look back over the past growing season at the weather and diseases that were prevalent, there were few surprise epidemics.

Temperatures remained below average for most of the growing season so degree day accumulation lagged behind long term averages and resulted in delayed crop growth and development. Northwest Iowa experienced the closest to normal temperatures while southeast Iowa had the greatest deviation from normal temperatures and was very cool (Pope, 2008).

The growing season started out wetter than usual. By mid-June, the state had received double the normal precipitation. For the remainder of the growing season, northwest Iowa received below average rainfall. However, for the rest of the state, conditions did not start to dry out until August. In late August, southeast Iowa had another very wet period as a result of Hurricane Ike. All areas except northeast Iowa received rain towards the end of September, when much of the corn across the state reached black layer, and most of the soybeans matured (Pope, 2008).

Corn

Common diseases

Anthrachnose leaf blight was common in corn following corn fields early on in the season. Lesions were found on the bottom 4 to 5 leaves of corn plants. The frequent precipitation that occurred early in the growing season favored inoculum spread and infection.

Although midseason diseases such as eyespot, common rust and gray leaf spot (GLS) occurred in many corn fields across the state this growing season, their severity was lower compared with the 2007 growing season. Some might argue that the incidence of common rust (percent of plants within a field with common rust pustules) was greater than in previous years, however the number of pustules on a single leaf plant was low and consequently whole plant disease severity usually never exceeded two percent. Gray leaf spot lesions first occurred on the lower leaves of corn plants towards the end of July, but the unseasonably cool, dry August with low humidity slowed GLS disease development considerably. Anthracnose top dieback was once again a problem in some fields, and anthracnose stalk rot continued to be the predominant stalk rot in Iowa.

A number of less common diseases also occurred.

(i) *Physoderma brown spot*

Physoderma brown spot is caused by *Physoderma maydis*, an organism which is closely related to the oomycetes (such as *Pythium* and the crazy top pathogen). This pathogen overwinters in

infected tissue or soil for up to 3 years and produces numerous zoospores in wet conditions. Corn plants are most susceptible 50-60 days after germination and become more resistant to infection with age. The zoospores of *P. maydis* infect leaf tissue when free water collects in the whorl and temperatures are between 70-85°F, thus resulting in the bands of infected and noninfected leaf tissue (Robertson, et al., 2008; White, 1999).

Symptoms usually appear on mid-canopy leaves. Broad bands of numerous, very small (approximately one-fourth inch in diameter), round to oval, yellowish to brown spots are characteristic of this disease. Dark purplish to black oval spots also occur on the midrib of the leaf. Physoderma brown spot is often misdiagnosed as eyespot or southern rust (Robertson, et al., 2008; White, 1999).

In the U.S. this disease is usually of minor importance and consequently resistance is not available (Robertson, et al., 2008; White, 1999). Because the pathogen can survive in infested crop residue, the disease is more common in corn following corn fields particularly if a lot of crop residue remains on the soil surface. Inoculum can be reduced by crop rotation or by reducing surface residue through tillage (Robertson, et al., 2008; White, 1999). Only Headline® lists Physoderma leaf spot on the label; however infections in Iowa are usually not severe enough to warrant a fungicide application.

(ii) Goss's wilt

There were numerous reports of Goss's wilt occurring in Iowa this growing season. Reports of Goss's wilt came from Boone, Calhoun, Carroll, Cass, Cedar, Chickasaw, Johnson, Keokuk and Pottawattamie (east) counties. There it appears the disease occurred in a band across central Iowa.

Goss's wilt was first reported on corn in Nebraska almost 40 years ago but since then has been reported across the entire Corn Belt. Even still it is rare to see Goss's wilt in Iowa. The disease is caused by the bacterium *Clavibacter michiganense* subsp. *nebraskensis*. Hosts of the bacterium include corn, green foxtail, barnyard grass and shattercane. Infested corn residue is the major source of inoculum for Goss's wilt and the bacterium can also be seedborne. Infection of leaves, stems and roots occurs primarily through wounds caused by sandblasting, hail, heavy rain or wind. Corn plants are susceptible at all growth stages (White, 1999).

Symptoms of Goss's wilt that were reported this growing season were leaf blight of the leaves at the top of corn plants, causing many to believe their corn had anthracnose top dieback. Closer examination of plants showed that affected leaves had large gray to reddish or yellow shiny lesions that extended down the leaf veins. Dark green to black "freckles" were evident within the lesions. These "freckles" are diagnostic for the disease. The bacterium also may infect the xylem (water-conducting) tissues of the plant and result in wilting and death of the plants (Robertson, et al., 2008; White, 1999); however, there were no reports of these symptoms.

The most effective management tool for Goss's wilt is to grow a partially resistant hybrid, so check with a seed dealer for hybrids that have resistance to Goss's wilt. The bacterium is short lived in broken up buried residue so tillage also is helpful. Other management practices include weed management and rotation to non-host crops (White, 1999).

There have been concerns raised regarding seed transmission of the bacterium. Work done at ISU in two separate studies showed transmission rate was <0.4% and 0.136%, respectively. Thus

seedborne inoculum is of minor concern in an area where the disease is established, but infected seeds could introduce the pathogen into new areas (Biddle et al., 1990).

(iii) Southern rust

An outbreak of southern rust occurred in Southwestern Iowa, leading to foliar fungicide applications in Taylor county targeted for southern rust. Southern rust is more of a concern than common rust on corn because it is more aggressive, so proper identification is important to make timely fungicide-management decisions. Yield loss due to southern rust, can be severe. In 2006, the disease resulted in yield losses up to 30% in south central Nebraska (Jackson, 2007).

Southern rust is favored by warm (77 to 82°F) and humid conditions while common rust is favored by cooler temperatures (Robertson et al., 2008, Jackson, 2007).

Symptoms of southern rust are similar to those of common rust with subtle differences. Southern rust pustules are light cinnamon brown to orange and usually circular, ranging in diameter from 0.2 to 2.0 mm. They tend to be densely scattered on upper leaf surfaces and rarely found on the under side of the leaf. Lesions of common rust are larger and more elongated. They are readily found scattered across both the upper and lower surfaces of the leaf. It is possible to have both rusts on the same leaf (Robertson et al., 2008, Jackson, 2007).

(iv) Diplodia ear rot

Diplodia ear rot was reported from the northeast, central and southeastern parts of Iowa in 2008. The disease was more prevalent this growing season than it has been in recent ears. Fusarium or Gibberella ear rot usually are the most common ear diseases in Iowa.

Diplodia ear rot is caused by the fungus *Stenocarpella maydis* (*Diplodia maydis*). The same fungus also causes Diplodia stalk rot. The fungus survives in corn residue and seed, and thus this disease tends to be of a problem in corn following corn fields. Diplodia ear rot is favored by cool, wet weather during grain fill. Infection occurs through the silks and/or ear shank, or via the base of the husks of the ear (Robertson, et al., 2008; White, 1999).

Symptoms of Diplodia ear rot are a bleached ear leaf and husk. When the husk is peeled back, a dense white to grayish white mold growth that starts at the base of the ear is evident growing between the kernels. Oftentimes the husks of the ear are difficult to remove and appear “glued” to the ear by the mold. Very small, black fruiting bodies called pycnidia can be found scattered on husks or embedded in cob tissues and kernels (Robertson, et al., 2008; White, 1999).

Although *S. maydis* does not appear to produce mycotoxins in the grain under field conditions usually occurring in Iowa, infected kernels are lightweight and have reduced nutritional value. Damage caused by Diplodia ear rot is usually limited to the field, but the pathogen can be a problem in storage if grain moisture is 20% or above (White, 1999).

Options for managing Diplodia ear rot are limited. Rotation out of corn is recommended since the fungus survives in residue. Hybrids do differ in their susceptibility to *S. maydis* so talk with your seed dealer (Robertson, et al., 2008; White, 1999).

Soybean

Lots of rain early in the year led to the early establishment of several foliar diseases. Brown spot, bacterial blight, frog-eye leaf spot and Cercospora leaf blight (CLB) were reported very early in

the season (Figure 1). However, as the season progressed, none of the diseases really became established and caused significant damage. Of these diseases, the two that were most prevalent at the end of the season were brown spot and *Cercospora* leaf blight.



Figure 1. Brown spot (left) and *Cercospora* leaf blight (right) found on soybean seedlings in 2008.

With the excessive soil moisture, came the expected root rots and seedling diseases. *Phytophthora* root rot was more prevalent than any year in recent memory. We will not be covering *Phytophthora* root rot in this talk.

General observations

- Late planted soybean fields had very little foliar diseases. Probably the main reason was that the canopy in these fields never completely closed. Except where Hurricane Ike clipped the southern part of the state, rainfall was normal or even less than normal (Pope, 2008) during the second half of July and August. Drier weather and more open canopies lead to less foliar disease pressure.
- If you would have asked me going into the season which of the foliar diseases could potentially cause the most yield loss, my answer would have been frogeye leaf spot. Based on the previous few years, frogeye leaf spot was widespread and severe in certain fields. What was different about the last two years compared to this season? Most likely, frequent rainfall in late July and August in 2006 and 2007.
- If it were not for *Septoria* brown spot, CLB and an occasional field with downy mildew, this would have been a relatively boring year, disease-wise, for soybean. Yes, sudden death syndrome and white mold were seen and brown stem rot was reported in western Iowa, but nothing too bad or exceptional.
- One production shift seen was an increase in the number of soybean acres sprayed with a foliar fungicide. Back in 2004, some tried foliar fungicides with decent success. In 2006 and 2007, soybean acreage sprayed with foliar fungicides dropped, as did yield responses to these applications. Because of the market or supposed success with fungicides on corn, fungicides

on soybean were given a second chance in 2008.

- The two most prevalent diseases seen in Iowa during the 2008 season were brown spot and *Cercospora* leaf blight. Along with frogeye leaf spot, these diseases all can be managed with a timely application of foliar fungicide. But are disease levels high enough in Iowa to merit a fungicide application?

(i) Brown spot

Brown spot is found in most fields in Iowa, but typically is confined to the lowest part of the canopy. Most growers know about this disease, but don't give it much thought. Does this disease cause enough damage to matter?

Two recent studies have suggested that brown spot could be a significant yield nibbler. At Ohio State University, a study was completed in 2007 looking at how brown spot affected yield. Chlorothalonil was applied throughout the season to attain different levels of brown spot. Where brown spot severity was the lowest, final yields were 4 and 2.8 bushels per acre over the nontreated control at two different locations, respectively (Dorrance, 2008).

A second study was done at the University of Florida, not specifically looking at brown spot, but instead looking at the lower canopy and how it contributes to yield. Two treatments of interest were a fungicide applied to runoff (100% coverage, even in the lower canopy) with and without the lower leaves being physically removed. Similar to the OSU study, lower canopy leaves did contribute to final yield (Mueller et al., 2007).

For 2008, brown spot could have been much worse. Some fields, especially in central Iowa, had 100% incidence early in the season. Because of poor canopy closure, the disease did not take over fields, but stayed in the lower canopy until late reproductive stages.

Fungicides can be effective at managing brown spot; however, the challenge is always getting the fungicide to the lower canopy. In 2008, some fungicide trials had very little brown spot in the treated areas, which again may trace back to the more open canopies allowing better penetration of fungicides and better management of brown spot.

(ii) *Cercospora* leaf blight

Cercospora leaf blight appears in the upper canopy as a purplish cast on the leaves. The infection actually does not occur on the affected leaf, but lower on the plant. The affected leaves are from a phytotoxin produced by the fungus.

We traveled to Louisiana in September to look at soybean rust (yes, I managed to mention soybean rust at least once). We were able to spend the better part of one day with Dr. Ray Schneider, who has been studying CLB for many years. What we learned was quite surprising, and I am still trying to figure how it relates back to Iowa.

- The aggressiveness of the fungus seems to have shifted in the past few years. Cultivars that were highly resistant are now susceptible.
- CLB is the number one foliar disease in Louisiana, by far. They actually do not even worry too much about soybean rust because all of their fields are getting at least one, often more, application of fungicide targeting CLB.
- Despite the targeted foliar fungicides, CLB is still very severe at the end of the season, once the fungicide residual wears off.

Despite not seeing as much frogeye leaf spot in Iowa during 2008, CLB was prevalent in many fields by growth stage R5. As far as fungicides for management of CLB, we still have much to learn. What we do know is that strobilurin fungicides are more effective than triazole fungicides (www.sbrfungicides.net). In some of our fungicide studies, CLB severity was reduced with an application of a foliar fungicide at R3. But it still was the most prevalent disease in the upper canopy in both the treated and non-treated plots.

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